Comments on Assignment #1
(AY2024/25 Semester 1)

General comments on Assignment #1

1. We spent a considerable amount of time sorting out those submissions that did not conform to the pagination of the template file. Assignment 2 will be done in the same manner so please submit a file that conforms to the requirement.
2. The boxes are provided so that you do not write excessively. The amount of space in the boxes is sufficient. If you need to write more than what the space allows, it is an indication that your answer is off the track, or you are writing more than what is required.
3. In your midterm test, you will be given an Answer Sheet to write on, which resembles the template given for your assignment 1, in which you are to write your answers within the boxes provided. Please do not write beyond the boxes, or attach additional sheets of paper, which will not only be ignored by us, but will also jam our scanning of your midterm Answer Sheets onto SoftMark, because the software is set to accept the exact number of pages for each student.
4. As a result, we advise students to write your answers in pencil (2B or above) on your midterm Answer Sheets, and bring along an eraser. You are to shade your Student Number with pencil, so that you can erase and re-shade if you make a mistake. Shading it with a pen and crossing out the wrong shading will NOT be recognised by the software!
5. There are a number of assignment 1 submissions where students shaded their Student Number wrongly. We can only find out who these students are after we have finished grading. If this happens in your midterm test, sorry, you will get ZERO mark for your test as your answer sheet cannot be identified. So, please check, double check, and triple check that you have shaded your Student Number correctly on the midterm answer sheet.
6. In the past, each tutor graded the assignment for his/her own group(s). In this semester, we arranged the marking of a question to be done by a single grader, or a small group (2 to 4) of graders. This is to ensure consistency of grading. Hence, if you find the grading is too strict, please do not ask for additional marks as the same strict grading scheme is applied to everybody. If we change the grading scheme, we will have to re-grade the whole class of over 900 students.

Graders

The following are the graders of the respective questions. If you have any queries on the grading, please contact the respective graders. The email addresses of all tutors are on the CS1231S web page: https://www.comp.nus.edu.sg/~cs1231s/1_course_info/staff.html

Q0.	Aaron Tan
Q1(a).	Chong Chin Herng
Q1(b).	Aaron Tan
Q2.	Jason Ciu
Q3.	Eldon Chung
Q4.	Guai Tze Yang Ryan, Eom IKhoon, Ang Wei Jian
Q5.	Chen Xu, Ding Feng, Garg Maahir Rajesh, Gorantla Shashank
Q6.	Enzio Kam, Nguyen Doan Phuong Anh, Jordan Mitchell Chan

Q0 (Graded by Aaron)

- All students submitted a pdf file with their Student Number. However, 72 students (about 8% of the class) lost one mark because either they did not write their tutorial group at all or correctly, or did not write both their name and tutorial group.

Q1(a) (Graded by Chong Chin Herng)

Part (i) mark	0	1
#students	23	882
%students	2.5%	97.5%

Part (ii) mark	0	0.5	1	1.5	2
#students	5	5	20	196	679
%students	0.6%	0.6%	2.1%	21.7%	75.0%

- Part (i): well attempted.
- Part (ii): mostly well attempted. Common mistakes include:
  - forgetting to apply commutative law,
  - citing identity law as universal bound law,
  - mixing up commutative law, associative law and distributive law,
  - using $=$ symbol instead of $\equiv$ symbol to denote logical equivalence.

Q1(b) (Graded by Aaron)

Mark	0	0.5	1	1.5	2	2.5	3	3.5	4
#students	13	25	23	23	33	49	90	98	553
%students	1.4%	2.8%	2.5%	2.5%	3.6%	5.4%	9.9%	10.8%	61%

- 61% of the class received full mark (4) for this question. For a basic question like this, and given that it is an assignment which you are given a number of days to work on and check, this is not something that is encouraging.
- We have emphasised the need to follow the laws rigorously and not to skip steps. This was conveyed not only in lecture, but also in all the tutorial classes. Tutorial 1 Q3a was specifically used to reinforce this. Moreover, this assignment question reminds students again: "Make sure you do not skip any step, and every step must be justified by a law. Do not combine two steps of the same law in a single step. Use **true** and **false** for tautology and contradiction respectively." And as the question warns that the grading will be strict, I adopted a very strict grading scheme.
- Despite the above, many students (about ¼ of the class) made mistakes such as:
  - Writing "T" and "F" instead of "true" and "false".
  - Combining two laws in a single step.
  - Combining the same law in two steps into a single step.
  - Applying a law without quoting it.
  - Calling a law by the wrong name. (This should not happen.)
- Some students wrote "reverse distributive law" or "converse of distributive law" when they wrote this:

$$(q \vee r) \wedge (q \vee \sim r) \equiv q \vee (r \wedge \sim r)$$

  There is no such thing. Distributive law is distributive law. It is a logical equivalence. So, going "from left to right" or "from right to left" is still the same distributive law.
- Below are a few examples of common mistakes made, mostly due to skipping the commutative law. My comment is "Did you apply the xxxxx law correctly?"

- $false \vee (p \wedge (r \vee q)) \equiv (p \wedge (r \vee q))$ (by identity law)

  The correct way should be:
  $false \vee (p \wedge (r \vee q)) \equiv (p \wedge (r \vee q)) \vee false$ (by commutative law)
  $\equiv (p \wedge (r \vee q))$ (by identity law)

- $((r \vee q) \wedge (\sim r \vee q)) \equiv (q \vee (r \wedge \sim r))$ (by distributive law)

  The correct way should be:
  $((r \vee q) \wedge (\sim r \vee q)) \equiv ((q \vee r) \wedge (\sim r \vee q))$ (by commutative law)
  $\equiv ((q \vee r) \wedge (q \vee \sim r))$ (by commutative law)
  $\equiv (q \vee (r \wedge \sim r))$ (by distributive law)

- $((r \wedge q) \vee q) \equiv q$ (by absorption law)

  The correct way should be:
  $((r \wedge q) \vee q) \equiv (q \vee (r \wedge q))$ (by commutative law)
  $\equiv (q \vee (q \wedge r))$ (by commutative law)
  $\equiv q$ (by absorption law)

- Some students wrote ambiguous statements because they forgot to put the parentheses when necessary:

  - $p \wedge ((q \vee r) \wedge (q \vee \sim r))$

    $\equiv p \wedge q \vee (r \wedge \sim r)$ (by distributive law) ← This is an ambiguous statement!!!

  When applying the distributive law, they forgot to put the parentheses. The correct way is:

  - $p \wedge ((q \vee r) \wedge (q \vee \sim r))$

    $\equiv p \wedge (q \vee (r \wedge \sim r))$ (by distributive law)

  Ambiguous statements are a big no-no. I deducted 2 marks if an ambiguous statement is seen, compared to a deduction of ½ mark for other errors.

Q2 (Graded by Jason Ciu)

Mark	0	1	2	3	4	5	6
#students	47	40	162	0	0	199	457
%students	5.2%	4.4%	17.9%	0%	0%	22.0%	50.5%

1. General Notes.

Student should remember that when we are proving an argument is valid, we are trying to prove that the following is a tautology (Tutorial 1 additional notes):

$$(P_1 \wedge P_2 \wedge \cdots \wedge P_n) \rightarrow K$$

where $P_1 . P_2, \cdots, P_n$ are the premises and K the conclusion.

The critical row method is just a shortcut to prove the above. However, in general, students need to know that proving the above statement is the same as proving any other conditional statements. This can be done in many ways, via proving that

- the statement is vacuoudly true, i.e., $(P_1 \wedge P_2 \wedge \cdots \wedge P_n) \equiv false$.
- the negation of the statement is false (prove by contradiction), i.e.,

$$(P_1 \wedge P_2 \wedge \cdots \wedge P_n) \wedge \sim K \equiv false$$

I feel that this idea is not well grasped by a good number of students, judging from how they structured their answers. If seems that they understand the critical row method without understanding the logic behind it. For example, about 150 students proved that the premises are contradicting, but proceeded to conclude that the argument is <u>invalid</u>.

2. General Rubrics

(a) (+1 mark) States argument is valid.
(b) (+4 marks) Correct proof and conclusion.
(c) (+1 mark) Complete justifications, including specialization and negation from Premise 3.

A lot of students missed out on point (c), inferring $\sim p \wedge r$, or $p \equiv false$ and $r \equiv true$ from Premise 3 without any justifications.

3. Common Mistakes, Forgivable (for now)

These mistakes are in terms of the completeness of the proof, which happened in MANY submissions:

- Making no assumptions at the start of the proof. I feel that this is often overlooked by students who take the truth of premises for granted. But in this question, where a premise will eventually be concluded as false, not assuming anything will be ambiguous.
- Cited proof by contradiction without first assuming that the negation of the statement is true. In this question, only P_2 and P_3 are needed to show contradiction. However, in the general case, $\sim K$ may also be needed, so it is better to explicitly state the assumption beforehand.

4. Common Mistakes, Unforgivable
    - (-1 mark) Missing justifications, such as specialization and negation from Premise 3.
    - (Given 2 marks) Proved premises are contradicting, but concluded that the argument is invalid. (See General Notes above.) Although only the last step is incorrect, this showed a deep misunderstanding in proving a valid argument.
    - (Given 0 mark) Proved by contradiction, but assuming that the Conclusion is true.
    - (Given 0 mark) Proofs that starts with "Let $p \equiv false$ and $r \equiv true$" without inferring from Premise 3, which is only considering 1 possible combination without disproving the possibilities of others.
    - (Given 0 mark) Proof by cases or partial exhaustion of the truth values, which is technically a truth table method.

Q3 (Graded by Eldon Chung)

Part (a) mark	0	1	2	3
#students	14	2	25	864
%students	1.6%	0.2%	2.8%	95.5%

Part (b) mark	0	0.5	1	1.5	2	2.5	3
#students	8	3	4	5	19	105	761
%students	0.9%	0.3%	0.4%	0.6%	2.1%	11.6%	84.1%

Q3 was well attempted, as can be seen from the tables above.

The most common error was the students confusing the empty set $\emptyset$ with the set containing the empty set $\{\emptyset\}$. More than 11% of the class made this mistake. This is important; they should know how to notate the empty set.

Another issue which was far less common but important to note: we use commas to delimit elements in a set; do NOT use semi-colons or full stops.

This is a draft report. More will be added when the tutors have completed their grading.

Prepared by Aaron Tan
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